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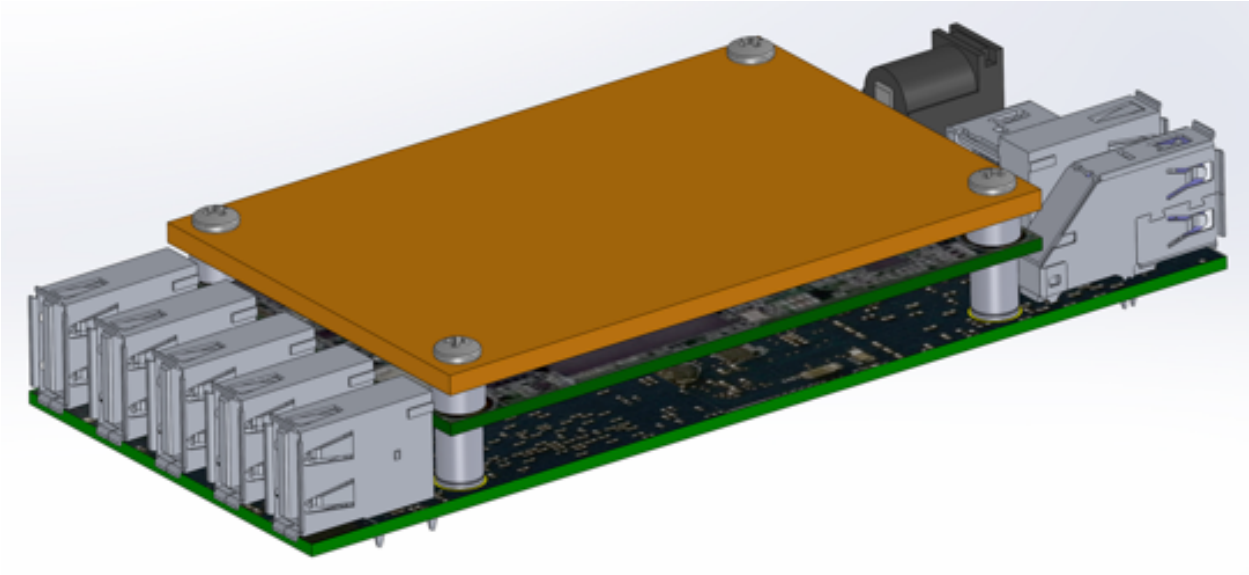
Piconium

“Pico” sized Comm Express Carrier
Industrial Grade, wide voltage range



Card - User Manual

Revision History

Date	Revision	Description
12/01/2014	0.10	Initial Revision
01/20/2015	0.2	Second Revision

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1. Description

Processor

Available as a COMX Type 10 Carrier card only -OR- with a choice of…
Congatec MA3 module with 3rd Generation Intel Atom or Celeron Processor
Single or Multi Core Processor, Various speeds, 1GB-8GB Ram

Specifications

Very Low Power (5-7W max) 10-28V single power supply via locking industrial grade connector
Industrial temp range (-40 to 100C)
Very Small, low profile form factor (approx. 130mm x 55mm)
LVDS display interface – single 24bit channel with LED control
6X USB 2.0
1X USB 3.0 (Super Speed)
1 HDMI port
Wifi (b,g,n) (via WiFi USB “dongle”)
Bluetooth 4.0 (via BT USB “dongle”)
Accessories available: LVDS displays & cables with touch panel, power supply, BT & WiFi “dongles”
Customizations are available for your specific needs

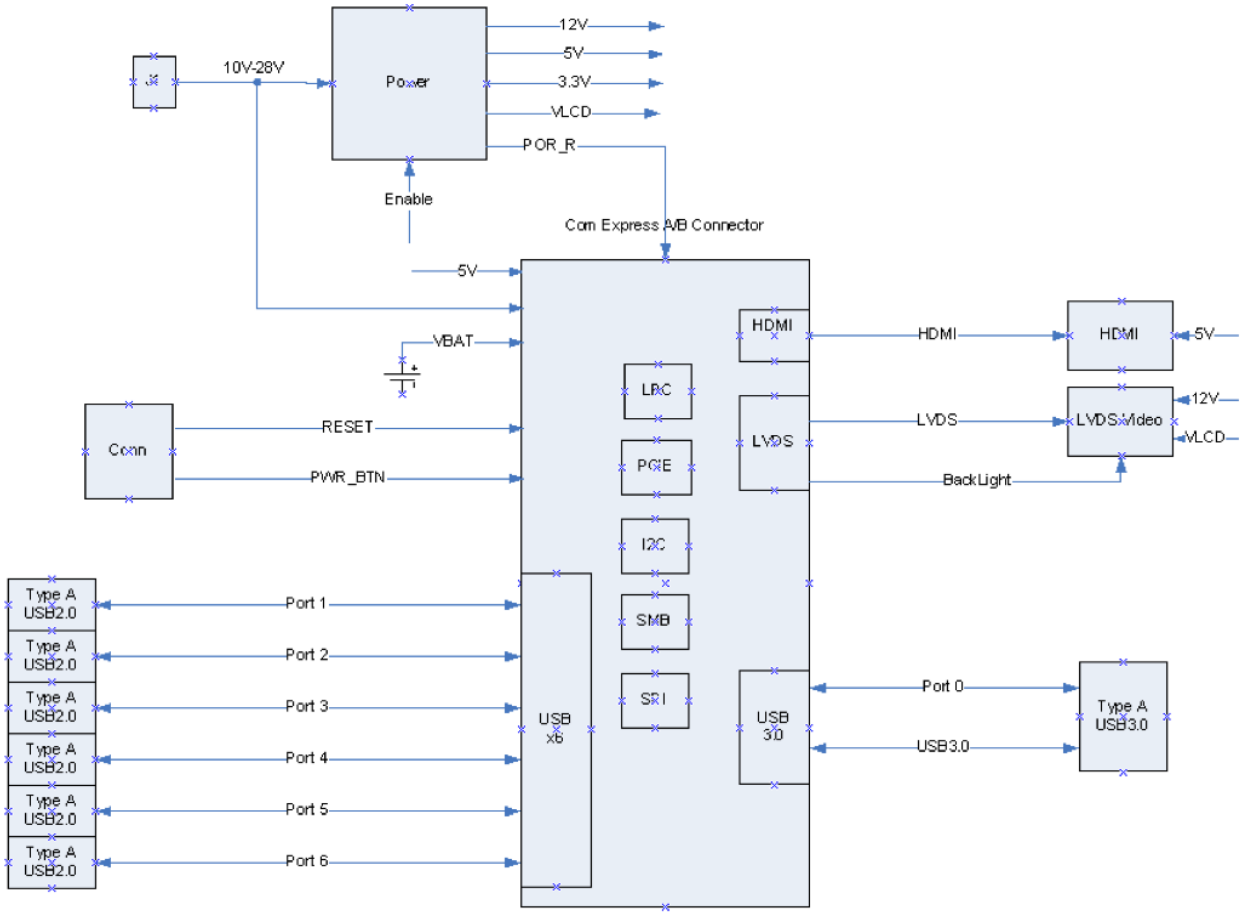
Operating System & Software

Designed for the Linux® Operating System (will work with others)
Available: USB 3.0 Flash Drive Preloaded with Ubuntu® 14.04 LTS Desktop, LUbuntu, Ubuntu Server &
Chromium Embedded Framework (CEF) for web based software development & deployment
Also available: BIOS programming tools boot drive (USB 2.0 thumb drive)

2. Abbreviations and Acronyms

Acronym	Definition
POR	Power On Reset
BSL	BootStrap Loader
USB	Universal Serial Bus
XTAL	Crystal
PLL	Phase Lock Loop
ADC	Analog to Digital Convertor
DAC	Digital to Analog Convertor
GPIO	General Purpose Input/Output
UART	Universal Asynchronous Receiver/Transmitter
I2C	Inter-IC Communication
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
LDO	Low Dropout Regulator
PTC	Positive Temperature Coefficient
NTC	Negative Temperature Coefficient
FET	Feild Effect Transistor
SPST	Single Pole Single Throw
BJT	Bipolar Junction Transistor
NC	No Connect
PTZ	Point, Tilt, Zoom
WFT	Wireless File Transfer

3. Block Diagram



Below is the block diagram of the ComExpress Carrier Board.

System Block Diagram

4. Functional Description

The primary function of the Piconium Carrier Board is to mount a type 10 ComExpress Module from any vendor. However, this board has been designed to interface with the Congatec MA3 type 10 module.

4.1. Com Express Interfaces

The physical interface to the Com Express module supports the A/B connector only and a sub set of the electrical interfaces. It is not in the scope of this document to define the Com Express electro-mechanical interface. More detailed information can be found in the Com Express Specification from PICMG.

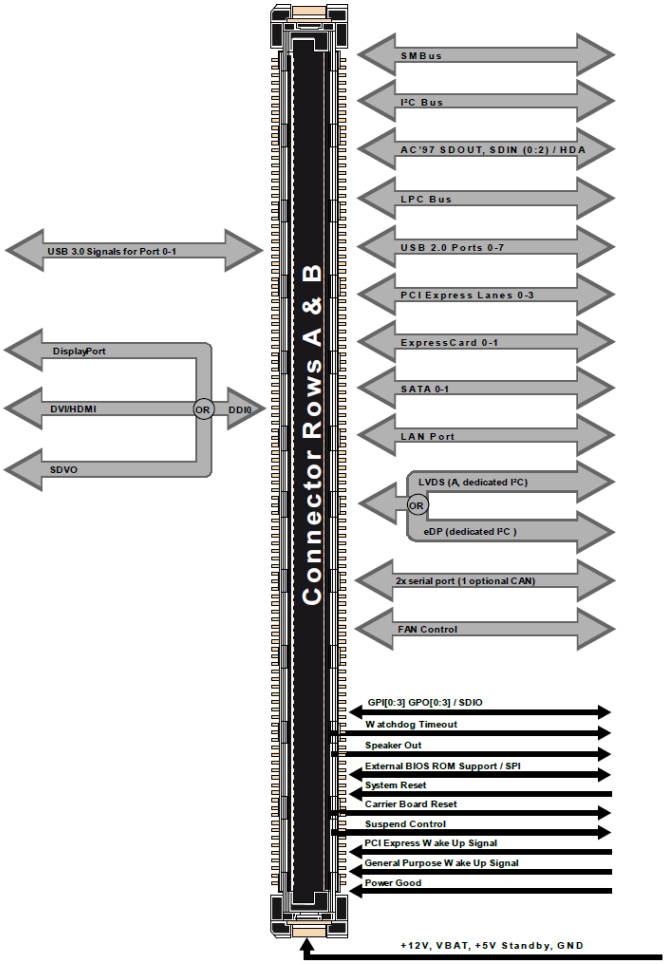


Figure 2: Connector A/B Overview

The next sections will briefly describe the main interfaces supported on the Com Express Carrier Board.

4.1.1. Power and Reset

Power Button, Reset & GND are provided to the connector. A connector on the carrier card provides the PWR_BTN and SYS_RESET inputs to the Com Express Board.

PWR & Reset Signals

Signal	Description
PWR_BTN_N	When asserted low, wakes up the system from S5 State.
SYS_RESET_N	When asserted low, the Com Express module resets and reboots

4.1.2. HDMI Video

HDMI is supported.

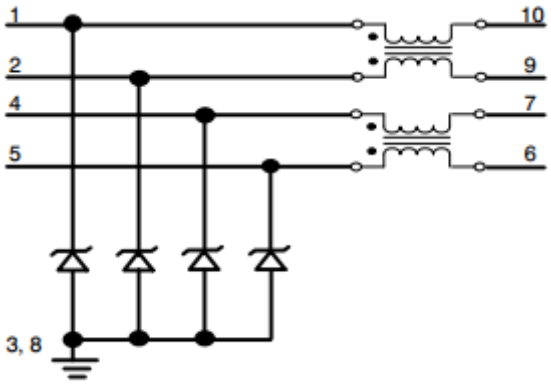
4.1.3. LVDS Video

The Com Express A/B connector supports up to 2 LVDS video interfaces.

Signal	Pin	Description	I/O	Comment
LVDS_A0+ LVDS_A0-	A71 A72	LVDS channel A differential signal pair 0	O LVDS	
LVDS_A1+ LVDS_A1-	A73 A74	LVDS channel A differential signal pair 1	O LVDS	
LVDS_A2+ LVDS_A2-	A75 A76	LVDS channel A differential signal pair 2	O LVDS	
LVDS_A3+ LVDS_A3-	A78 A79	LVDS channel A differential signal pair 3	O LVDS	
LVDS_A_CK+ LVDS_A_CK-	A81 A82	LVDS channel A differential clock pair	O LVDS	
LVDS_B0+ LVDS_B0-	B71 B72	LVDS channel B differential signal pair 0	O LVDS	
LVDS_B1+ LVDS_B1-	B73 B74	LVDS channel B differential signal pair 1	O LVDS	
LVDS_B2+ LVDS_B2-	B75 B76	LVDS channel B differential signal pair 2	O LVDS	
LVDS_B3+ LVDS_B3-	B77 B78	LVDS channel B differential signal pair 3	O LVDS	
LVDS_B_CK+ LVDS_B_CK-	B81 B82	LVDS channel B differential clock pair	O LVDS	
LVDS_VDD_EN	A77	LVDS flat panel power enable.	O 3.3V, CMOS	
LVDS_BKLT_EN	B79	LVDS flat panel backlight enable high active signal	O 3.3V, CMOS	
LVDS_BKLT_CTRL	B83	LVDS flat panel backlight brightness control	O 3.3V, CMOS	
LVDS_I2C_CK	A83	DDC I2C clock signal used for flat panel detection and control.	O 3.3V, CMOS	
LVDS_I2C_DAT	A84	DDC I2C data signal used for flat panel detection and control.	I/O 3.3V, OD CMOS	

Com Express Signals: LVDS

The carrier board routes only channel "A" to a 20 pin header for interface to a monitor via a custom cable. All differential pairs are protected from ESD using EMI4182 common mode filter with low capacitance (0.8pf) ESD protection.



High Speed Filter and Transient Protection

4.1.4. USB

The Com Express specification supports eight USB ports along with over current detection for each port pair. Piconium supports 6 USB 2.0 ports and 1 USB 3.0 port (with 2.0 backwards compatibility)

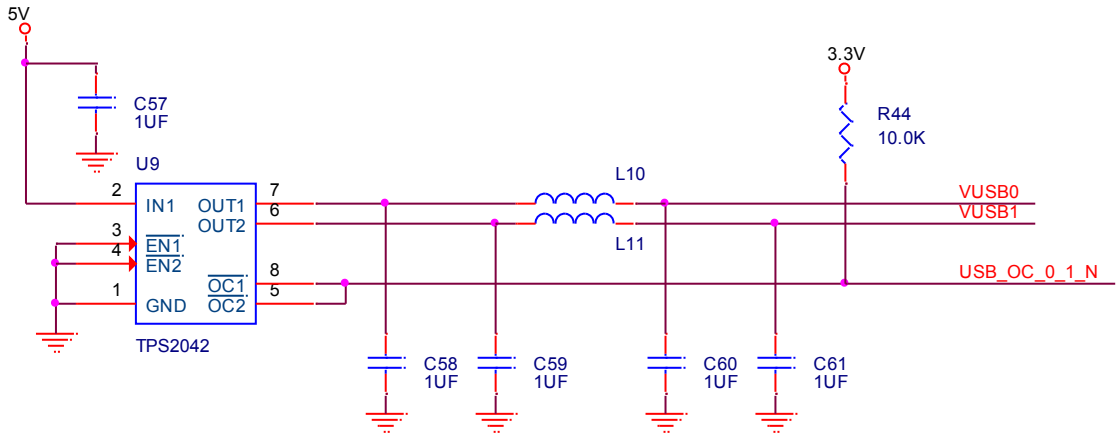
Signal	Pin #	Description	I/O	Comment
USB0+	A46	USB Port 0, data + or D+	I/O USB	mandatory on Module
USB0-	A45	USB Port 0, data - or D-	I/O USB	mandatory on Module
USB1+	B46	USB Port 1, data + or D+	I/O USB	mandatory on Module
USB1-	B45	USB Port 1, data - or D-	I/O USB	mandatory on Module
USB2+	A43	USB Port 2, data + or D+	I/O USB	mandatory on Module
USB2-	A42	USB Port 2, data - or D-	I/O USB	mandatory on Module
USB3+	B43	USB Port 3, data + or D+	I/O USB	mandatory on Module
USB3-	B42	USB Port 3, data - or D-	I/O USB	mandatory on Module
USB4+	A40	USB Port 4, data + or D+	I/O USB	optional on Module
USB4-	A39	USB Port 4, data - or D-	I/O USB	optional on Module
USB5+	B40	USB Port 5, data + or D+	I/O USB	optional on Module
USB5-	B39	USB Port 5, data - or D-	I/O USB	optional on Module
USB6+	A37	USB Port 6, data + or D+	I/O USB	optional on Module
USB6-	A36	USB Port 6, data - or D-	I/O USB	optional on Module
USB7+	B37	USB Port 7, data + or D+	I/O USB	optional on Module
USB7-	B36	USB Port 7, data - or D-	I/O USB	optional on Module
USB_0_1_OC#	B44	USB over-current sense, USB ports 0 and 1.	I 3.3V CMOS	optional on Module
USB_2_3_OC#	A44	USB over-current sense, USB ports 2 and 3.	I 3.3VCMOS	optional on Module
USB_4_5_OC#	B38	USB over-current sense, USB ports 4 and 5.	I 3.3V CMOS	optional on Module
USB_6_7_OC#	A38	USB over-current sense, USB ports 6 and 7.	I 3.3V CMOS	optional on Module

Com Express Signals: USB

USB Port Allocation

Port	Description
0	Routed to P7 for USB2.0 compatibility for the USB 3.0 port
1	Routed to P2 and right angle Type A connector
2	Routed to P8 and right angle Type A connector
3	Routed to P3 and right angle Type A connector
4	Routed to P4 and right angle Type A connector
5	Routed to P5 and right angle Type A connector
6	Routed to P6 and right angle Type A connector

The power to each connector is enabled using a TPS2042 power switch which is always on. The TPS2042 supports two switches and current monitors. Below shows the configuration of the TPS2042 for ports 0 and 1. This is duplicated for the other port pairs.

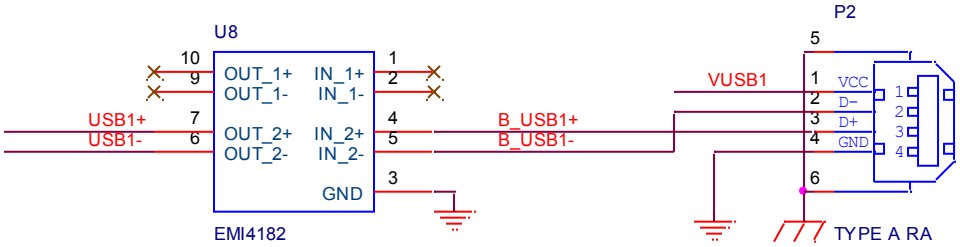


USB Power Switch and Current Monitoring

The TPS2042 also monitors the current draw on VBUSx and asserts the respective OC output which is an open drain output, pulled up and connected to the OC_N inputs to the Com Express module.

4.1.4.1. Port 1

Port 1 is connected to a Type A connector and is filter and protected using an EMI4182 device.



USB Port 1

4.1.5. Unused Interfaces

The carrier card does not utilize the following ports on the A/B connector.

- Low Pin Count (LPC)
- SPI
- SMB
- I2C
- PCI Express
- SATA
- Ethernet

5. Power

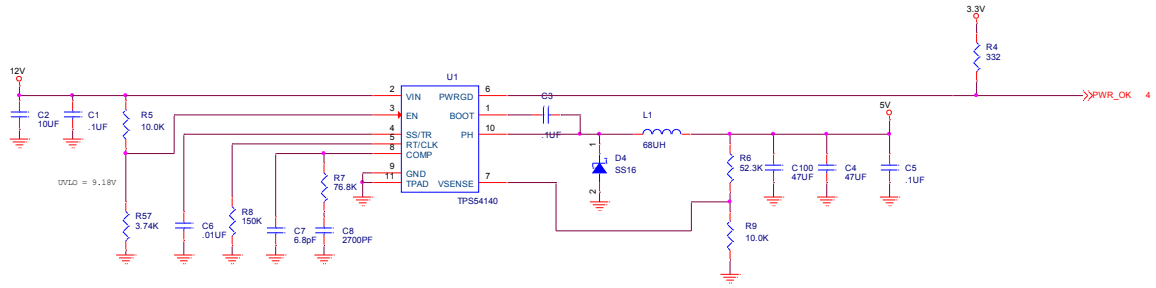
The input power comes from an external 10-28V supply and enters the system at J1. The input voltage is regulated down to 3.3V, 5V and V_LCD which can be configured as a 5V or 3.3V output via a shunt. Likewise, the input voltage is regulated up or down to provide 12V for the LCD display. Each supply has an LED associated with it that illuminates when the supply is on. Refer to Section 0.

5.1. Low Voltage Regulation

5.1.1. 5V Regulation

To generate the 5V, a Texas Instrument TPS54140 Buck switch with adjustable output is used. The TPS54140 can supply up to 1.5A of current and provides over current protection.

The TPS54140 is configured to regulate at 5V via the VSENSE voltage which is set by R6 and R9. R5 and R57 also provide an under voltage protection and will only allow the supply to regulate if the input voltage is greater than 9.18V.



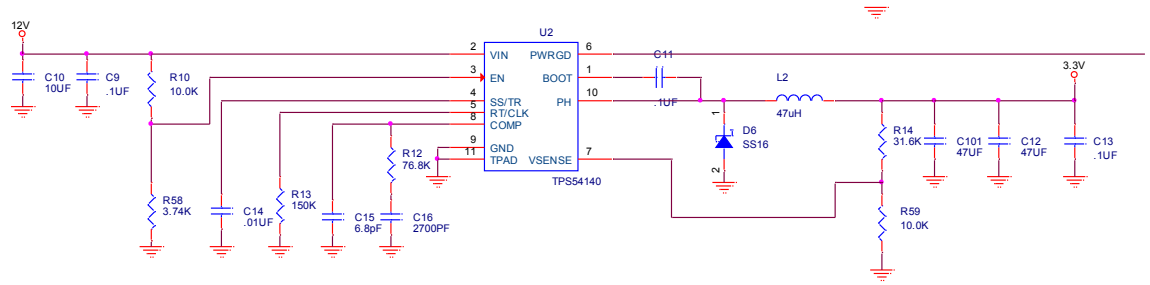
5V Regulation

PWR_OK is routed to the Com Express module indicating all power supplies are valid.

5.1.2. 3.3V Regulation

To generate the 3.3V, a Texas Instrument TPS54140 Buck switch with adjustable output is used. The TPS54140 can supply up to 1.5A of current and provides over current protection.

The TPS54140 is configured to regulate at 3.3V via the VSENSE voltage which is set by R14 and R59. R10 and R58 also provide an under voltage protection and will only allow the supply to regulate if the input voltage is greater than 9.18V.



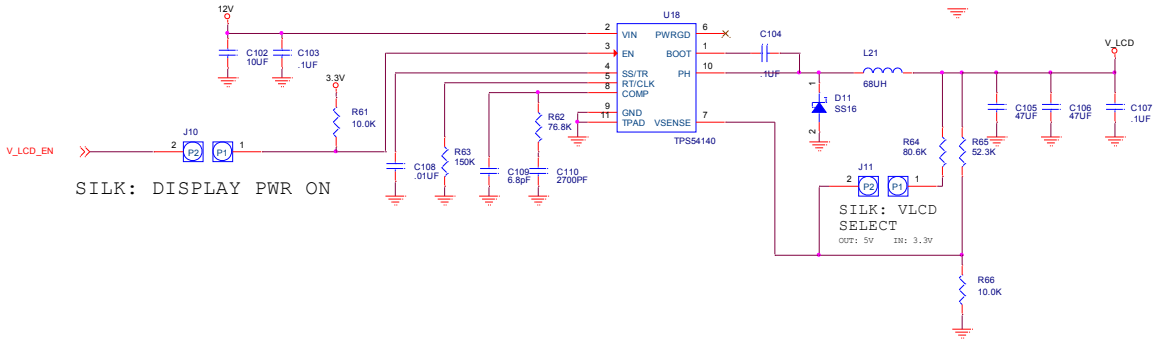
3.3V Regulator

The PWRGD signal, being an open-drain output is connected to PWR_OK signal of the 5V regulator.

5.1.3. VLCD Regulation

The V_LCD rail for the LVDS monitor is also derived using a Texas Instrument TPS54140 Buck switch with adjustable output. The TPS54140 can supply up to 1.5A of current and provides over current protection.

The TPS54140 is configured to regulate at 3.3V or 5V via the VSENSE voltage which is set by R64, R65 and R56. The Shunt J11 adds R64 to the circuit and if not installed, adjusts the output to be 5V and if installed, creates a parallel resistance between R64 and R65 (31.6K) and adjusts the output to be 3.3V.



V_LCD Regulator

The Enable input is pulled up to 3.3V and if the shunt J10 is not installed, the regulator is enabled. If J10 is installed, then software can control the enable via the V_LCD_ON signal from the Com Express Module.

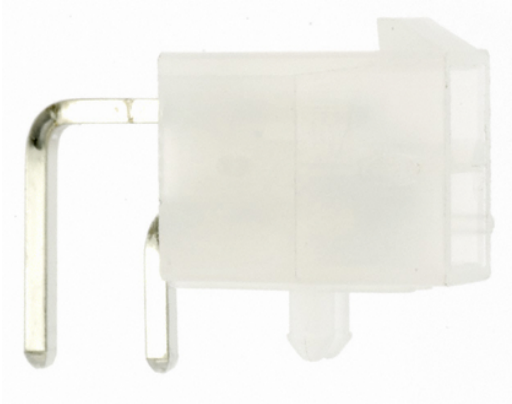
6. Connectors

6.1. Com Express A/B Connector

Refer to the Com Express Specification for the pin-out of this connectors.

6.2. Power Connector (J1)

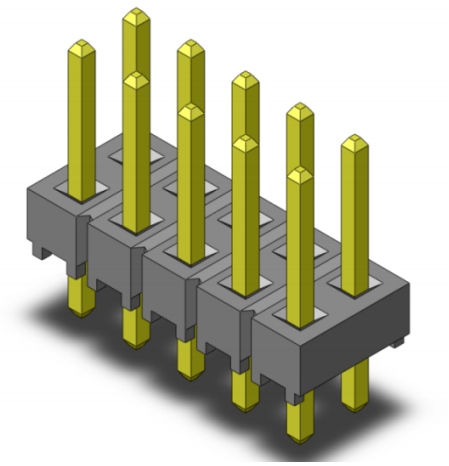
J1 is a Molex 39-30-1020 1x2 Right Angle Mini-Fit Jr. connector that provides power to enter onto the board.



Pin	Description
1	12V In
2	Ground

6.3. Reset Connector (CN1)

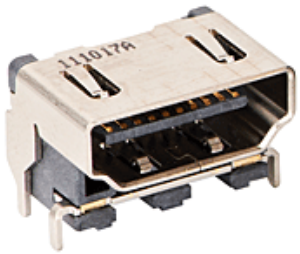
CN1 is a Samtec TSW-105-07-G-D 2x5 2.54mm header that provides connectivity to external peripherals.



Pin	Description
1	GND
2	PWR_BTN_R
3	GND
4	SYS_RESET_N

6.4. HDMI Connector (J12)

J12 is a JAE Electronics DP1RD20JQ1R400 Right Angle Display Port Connector that



provides connectivity to external Display Port Monitors

Pin	Description
1	D2+
2	D2 Shield
3	D2-
4	D1+
5	D1 Shield
6	D1-
7	D0+
8	D0 Shield
9	D0-
10	CLK+
11	CLK Shield
12	CLK-
13	CE Remote
14	NC
15	DDC_CLK
16	DDC_DATA
17	GND
18	5V
19	HP_DETECT

6.5. LVDS Connector

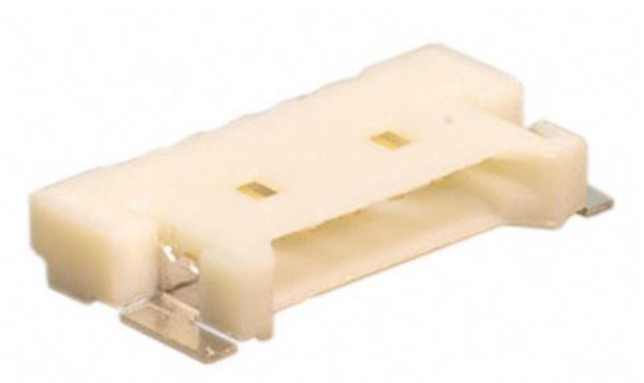
J7 is a Hirose df14-20p-1.25 1x20 header that provides connectivity to external LVDS

Displays.

Pin	Description
1	V_LCD
2	V_LCD
3	GND
4	NC
5	LVDS0-
6	LVDS0-
7	GND
8	LVDS1-
9	LVDS1+
10	GND
11	LVDS2-
12	LVDS2+
13	GND
14	LVDS_CLK-
15	LVDS_CLK+
16	GND
17	LVDS3-
18	LVDS3+
19	GND
20	6/8 bit select (jumper)

6.6. Backlight Connector (J8)

CN1 is a Hirose B5B-PH-SM4-TB(LF)(SN) 1x5 2.54mm header that provides connectivity to the backlight power of LVDS Monitors.



Pin	Description
1	12V
2	LVDS_BKLT_EN
3	GND
4	LVDS_BKLT_CTRL
5	5V

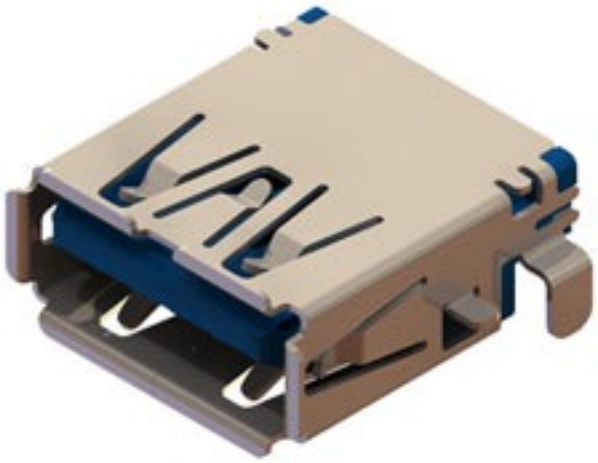
6.7. USB 2.0 Type A Connector (P2, P3, P4, P5, P6, P8)

P2 is an Amp 292336-1 Vertical Mount Type A USB connector that provides connectivity to external peripherals.

Pin	Description
1	VUSB1
2	USB1-
3	USB1+
4	GND

6.8. USB 3.0 SS Connector (P7)

P7 is an Amp 292336-1 Horizontal Mount Type A USB connector that provides connectivity to external peripherals.



Pin	Description	USB
1	VUSB1	2.0 and 3.0
2	USB1-	2.0
3	USB1+	2.0
4	GND	2.0
5	RX-	3.0
6	RX+	3.0
7	GND	3.0
8	TX-	3.0
9	TX+	3.0

7. LEDs

There are LEDs on the board as described below;

LED	Signal	Description
D2	5V	On when 5V is valid
D3	3.3V	On when 3.3V is valid
D12	V_LCD	On when the 5V to the LVDS is enabled

8. Switches and Shunts

8.1. Shunts

There are four shunts on the board. They are defined below.

Shunt	State	Description
J10	In	Allows software control of the V_LCD Enable
J10	Out	V_LCD is forced on
J11	In	V_LCD = 3.3V
J11	Out	V_LCD = 5V